

Designs for Hole-Boring and Integrated Fast Ignitor Experiments*

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With experiments on laser systems combining Nova with the 100-terawatt and the Petawatt short-pulse lasers we plan to test several elements of the "Fast Ignitor" technique. This is a proposed, novel technique for achieving inertial fusion in which the fuel is assembled, but not ignited, in a relatively cold implosion. A powerful and very short laser pulse, $I > 10^{19} \text{ W cm}^{-2}$, then ignites a spot on one side of the dense imploded material. In order for the high-intensity pulse to reach the dense matter, a longer, less intense laser pulse must first bore a hole or channel through the ablated plasma.

We present a design for an integrated implosion/hole-boring/high-intensity-energy-deposition experiment using the Petawatt/Nova-10-beam system. For that experiment we present computational studies addressing several design issues, especially the hole-boring element.

We present our designs, based on those studies, for early tests of the hole-boring element using the 100-terawatt/Nova-2-beam laser system. In these proposed experiments Nova beams illuminate one or two sides of a low-Z foil, creating an ablated blowoff plasma similar to that expected in the integrated experiments. A hole through the blowoff plasma and through/into the remaining high density material is produced by the 100-terawatt laser with a $\sim 160 \text{ ps}$ pulse at $I \sim 10^{17} \text{ W cm}^{-2}$. We discuss and model proposed diagnostic techniques for these experiments including interferometry and transmitted light.

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